

What is claimed is:

1. A system for detecting an analyte in a fluid comprising:
  - 5 a light source;
  - a sensor array, the sensor array comprising a supporting member comprising at least one cavity formed within the supporting member;
  - 10 a particle, the particle positioned within the cavity, wherein the particle is configured to produce a signal when the particle interacts with the analyte during use; and
  - 15 a detector, the detector being configured to detect the signal produced by the interaction of the analyte with the particle during use;
  - 20 wherein the light source and detector are positioned such that light passes from the light source, to the particle, and onto the detector during use.
2. The system of claim 1, wherein the system comprises a plurality of particles positioned within a plurality of cavities, and wherein the system is configured to substantially simultaneously detect a plurality of analytes in the fluid.
3. The system of claim 1, wherein the system comprises a plurality of particles positioned within the cavity.
- 25 4. The system of claim 1, wherein the light source comprises a light emitting diode.
5. The system of claim 1, wherein the light source comprises a white light source.
- 30 6. The system of claim 1, wherein the sensor array further comprises a bottom layer and a

top cover layer, wherein the bottom layer is coupled to a bottom surface of the supporting member, and wherein the top cover layer is coupled to a top surface of the supporting member; and wherein both the bottom layer and the top cover layer are coupled to the supporting member such that the particle is substantially contained within the cavity by bottom layer and the top cover layer.

5

7. The system of claim 1, wherein the sensor array further comprises a bottom layer and a top cover layer, wherein the bottom layer is coupled to a bottom surface of the supporting member, and wherein the top cover layer is coupled to a top surface of the supporting member; and wherein both the bottom layer and the top cover layer are coupled to the supporting member such that the particle is substantially contained within the cavity by bottom layer and the top cover layer, and wherein the bottom layer and the top cover layer are substantially transparent to light produced by the light source.
- 10
- 15
8. The system of claim 1, wherein the sensor array further comprises a bottom layer coupled to the supporting member, and wherein the supporting member comprises silicon, and wherein the bottom layer comprises silicon nitride.
9. The system of claim 1, wherein the sensor array further comprises a sensing cavity formed on a bottom surface of the sensor array.
- 20
10. The system of claim 1, wherein the supporting member is formed from a plastic material, and wherein the sensor array further comprises a top cover layer, the top cover layer being coupled to the supporting member such that the particle is substantially contained within the cavity, and wherein the top cover layer is configured to allow the fluid to pass through the top cover layer to the particle, and wherein both the supporting member and the top cover layer are substantially transparent to light produced by the light source.
- 25
11. The system of claim 1, further comprising a fluid delivery system coupled to the

supporting member.

12. The system of claim 1, wherein the detector comprises a charge-coupled device.
- 5 13. The system of claim 1, wherein the detector comprises an ultraviolet detector.
14. The system of claim 1, wherein the detector comprises a fluorescence detector.
- 10 15. The system of claim 1, wherein the detector comprises a semiconductor based photodetector, and wherein the detector is coupled to the sensor array.
16. The system of claim 1, wherein the particle ranges from about 0.05 micron to about 500 microns.
- 15 17. The system of claim 1, wherein a volume of the particle changes when contacted with the fluid.
18. The system of claim 1, wherein the particle comprises a metal oxide particle.
- 20 19. The system of claim 1, wherein the particle comprises a metal quantum particle.
- 25 20. The system of claim 1, wherein the particle comprises a semiconductor quantum particle.
21. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin.
22. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the polymeric resin comprises polystyrene-polyethylene glycol-divinyl benzene.

23. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the receptor molecule produces the signal in response to the pH of the fluid.

5

24. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the analyte comprises a metal ion, and wherein the receptor produces the signal in response to the presence of the metal ion.

10 25. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the analyte comprises a carbohydrate, and wherein the receptor produces a signal in response to the presence of a carbohydrate.

15  
20  
25

26. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the particles further comprises a first indicator and a second indicator, the first and second indicators being coupled to the receptor, wherein the interaction of the receptor with the analyte causes the first and second indicators to interact such that the signal is produced.

20 27. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the particles further comprises an indicator, wherein the indicator is associated with the receptor such that in the presence of the analyte the indicator is displaced from the receptor to produce the signal.

25 28. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the receptor comprises a polynucleotide.

29. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the receptor comprises a peptide.

30. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the receptor comprises an enzyme.

5 31. The system o f claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the receptor comprises a synthetic receptor.

32. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the receptor comprises an unnatural biopolymer.

10

33. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the receptor comprises an antibody.

34. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the receptor comprises an antigen.

35. The system of claim 1, wherein the analyte comprises phosphate functional groups, and wherein the particle is configured to produce the signal in the presence of the phosphate functional groups.

20

36. The system of claim 1, wherein the analyte comprises bacteria, and wherein the particle is configured to produce the signal in the presence of the bacteria.

25

37. The system of claim 1, wherein the system comprises a plurality of particles positioned within a plurality of cavities, and wherein the plurality of particles produce a detectable pattern in the presence of the analyte.

38. The system of claim 1, wherein the supporting member comprises silicon.

39. The system of claim 1, wherein the sensor array further comprises a top cover layer, wherein the top cover layer is coupled to a top surface of the supporting member such that the particle is substantially contained within the cavity by the top cover layer.

5 40. The system of claim 1, wherein the sensor array further comprises a bottom layer coupled to the supporting member, and wherein the bottom layer comprises silicon nitride.

41. The system of claim 1, wherein the particles produce a detectable pattern in the presence of the analyte.

10

42. The system of claim 1, wherein the cavity is configured such that the fluid entering the cavity passes through the supporting member during use.

15 43. The system of claim 1, wherein the light source comprises a red light emitting diode, a blue light emitting diode, and a green light emitting diode.

44. The system of claim 1, wherein the sensor array further comprises a cover layer coupled to the supporting member and a bottom layer coupled to the supporting member, wherein the cover layer and the bottom layer are removable.

20

45. The system of claim 1, wherein the sensor array further comprises a cover layer coupled to the supporting member and a bottom layer coupled to the supporting member, wherein the cover layer and the bottom layer are removable, and wherein the cover layer and the bottom layer include openings that are substantially aligned with the cavities during use.

25

46. The system of claim 1, wherein the sensor array further comprises a cover layer coupled to the supporting member and a bottom layer coupled to the supporting member, wherein the bottom layer is coupled to a bottom surface of the supporting member and wherein the cover layer is removable, and wherein the cover layer and the bottom layer include openings that

are substantially aligned with the cavities during use.

47. The system of claim 1, wherein the sensor array further comprises a cover layer coupled to the supporting member and a bottom layer coupled to the supporting member, wherein an opening is formed in the cover layer substantially aligned with the cavity, and wherein an opening is formed in the bottom layer substantially aligned with the cavity.

48. The system of claim 1, wherein the cavity is substantially tapered such that the width of the cavity narrows in a direction from a top surface of the supporting member toward a bottom surface of the supporting member, and wherein a minimum width of the cavity is substantially less than a width of the particle.

49. The system of claim 1, wherein a width of a bottom portion of the cavity is substantially less than a width of a top portion of the cavity, and wherein the width of the bottom portion of the cavity is substantially less than a width of the particle.

50. The system of claim 1, wherein the sensor array further comprises a cover layer coupled to the supporting member and a bottom layer coupled to the supporting member, wherein the bottom layer is configured to support the particle, and wherein an opening is formed in the cover layer substantially aligned with the cavity.

51. The system of claim 1, further comprising a removable cover layer.

52. The system of claim 1, wherein the supporting member comprises a plastic material.

53. The system of claim 1, wherein the supporting member comprises a silicon wafer.

54. The system of claim 1, wherein the supporting member comprises a dry film photoresist material.

55. The system of claim 1, wherein the supporting member comprises a plurality of layers of a dry film photoresist material.

5 56. The system of claim 1, wherein an inner surface of the cavity is coated with a reflective material.

10 57. The system of claim 1, further comprising channels in the supporting member, wherein the channels are configured to allow the fluid to flow through the channels into and away from the cavity.

15 58. The system of claim 1, wherein the sensor array further comprises a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity, and wherein a channel is formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use.

20 59. The system of claim 1, wherein the sensor array further comprises a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity, and wherein a channel is formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises a diaphragm pump.

25 60. The system of claim 1, wherein the sensor array further comprises a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity, and wherein a channel is formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises a diaphragm pump, and wherein the pump comprises an electrode pump.

61. The system of claim 1 wherein the sensor array further comprises a pump coupled to the

supporting member, wherein the pump is configured to direct the fluid towards the cavity, and wherein a channel is formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises a diaphragm pump, and wherein the pump comprises a piezoelectric pump.

5

62. The system of claim 1, wherein the sensor array further comprises a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity, and wherein a channel is formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises a diaphragm pump, and wherein the pump comprises a pneumatic activated pump.

10

63. The system of claim 1, wherein the sensor array further comprises a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity, and wherein a channel is formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises a diaphragm pump, and wherein the pump comprises a heat activated pump.

15

20

64. The system of claim 1, wherein the sensor array further comprises a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity, and wherein a channel is formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises a diaphragm pump, and wherein the pump comprises a peristaltic pump.

25

65. The system of claim 1, wherein the sensor array further comprises a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity, and wherein a channel is formed in the supporting member, the channel coupling the pump to

the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises a diaphragm pump, and wherein the pump comprises an electroosmosis pump.

- 5      66. The system of claim 1, wherein the sensor array further comprises a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity, and wherein a channel is formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises a diaphragm pump, and wherein the pump comprises an electrohydrodynamic pump.
- 10
67. The system of claim 1, wherein the sensor array further comprises a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity, and wherein a channel is formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises a diaphragm pump, and wherein the pump comprises an electroosmosis pump and an electrohydrodynamic pump.
- 15
68. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the particle further comprises a first indicator and a second indicator, the first and second indicators being coupled to the receptor, wherein the interaction of the receptor with the analyte causes the first and second indicators to interact such that the signal is produced.
- 20
- 25      69. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the particle further comprises an indicator, wherein the indicator is associated with the receptor such that in the presence of the analyte the indicator is displaced from the receptor to produce the signal.

70. The system of claim 1, wherein a portion of the supporting member is substantially transparent to a portion of light produced by the light source.
71. The system of claim 1, wherein the particle is coupled to the supporting member with via an adhesive material.
- 5
72. The system of claim 1, wherein the particle are coupled to the supporting member via a gel material.
- 10
73. The system of claim 1, wherein the particle is suspended in a gel material, the gel material covering a portion of the supporting member, and wherein a portion of the particle extends from the upper surface of the gel.
- 15
74. The system of claim 1, wherein the sensor array further comprises a cover coupled to the supporting member, positioned above the particle, wherein a force exerted by the cover on the particle inhibits the displacement of the particle from the supporting member.
75. The system of claim 1, wherein the supporting member comprises glass.
- 20
76. The system of claim 1, wherein the supporting member is composed of a material substantially transparent to ultraviolet light.
77. The system of claim 1, further comprising a conduit coupled to the sensor array, wherein the conduit is configured to conduct the fluid sample to and away from the sensor array; and a vacuum chamber coupled to the conduit, wherein the vacuum chamber comprises a breakable barrier positioned between the chamber and the conduit, and wherein the chamber is configured to pull the fluid through the conduit when the breakable barrier is punctured.
- 25
78. The system of claim 1, further comprising a conduit coupled to the sensor array, wherein the

conduit is configured to conduct the fluid sample to and away from the sensor array; and a vacuum chamber coupled to the conduit, wherein the vacuum chamber comprises a breakable barrier positioned between the chamber and the conduit, and wherein the chamber is configured to pull the fluid through the conduit when the breakable barrier is punctured, and further comprising a filter coupled to the conduit and the sensor array, wherein the fluid passes through the filter before reaching the sensor array.

79. The system of claim 1, further comprising a conduit coupled to the sensor array, wherein the conduit is configured to conduct the fluid sample to and away from the sensor array; and a

vacuum chamber coupled to the conduit, wherein the vacuum chamber comprises a breakable barrier positioned between the chamber and the conduit, and wherein the chamber is configured to pull the fluid through the conduit when the breakable barrier is punctured, and further comprising a filter coupled to the conduit and the sensor array, wherein the fluid passes through the filter before reaching the sensor array, and wherein the fluid is a blood sample, and wherein the filter comprises a membrane for the removal of particulates.

80. The system of claim 1, further comprising a conduit coupled to the sensor array, wherein the conduit is configured to conduct the fluid sample to and away from the sensor array; and a

vacuum chamber coupled to the conduit, wherein the vacuum chamber comprises a breakable barrier positioned between the chamber and the conduit, and wherein the chamber is configured to pull the fluid through the conduit when the breakable barrier is punctured, and further comprising a filter coupled to the conduit and the sensor array, wherein the fluid passes through the filter before reaching the sensor array, and wherein the fluid is a blood sample, and wherein the filter comprises a membrane for removal of white and red blood cells from the blood.

25  
81. The system of claim 1, wherein the particle comprises a biopolymer coupled to a polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal.

82. The system of claim 1, wherein the particle comprises a biopolymer coupled to a polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the chemical reaction comprises cleavage of the biopolymer by the analyte.
- 5
83. The system of claim 1, wherein the particle comprises a biopolymer coupled to a polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the biopolymer comprises a peptide, and wherein the analyte comprises a protease, and wherein the chemical reaction comprises cleavage of the peptide by the protease.
- 10
84. The system of claim 1, wherein the particle comprises a biopolymer coupled to a polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the biopolymer comprises a polynucleotide, and wherein the analyte comprises a nuclease, and wherein the chemical reaction comprises cleavage of the polynucleotide by the nuclease.
- 15
85. The system of claim 1, wherein the particle comprises a biopolymer coupled to a polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the biopolymer comprises an oligosaccharide, and wherein the analyte comprises an oligosaccharide cleaving agent, and wherein the chemical reaction comprises cleavage of the oligosaccharide by the oligosaccharide cleaving agent.
- 20
- 25 86. The system of claim 1, wherein the particle comprises a biopolymer coupled to a polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the particle further comprises a first indicator and a second indicator, the first and second indicators being coupled to the biopolymer, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes a

distance between the first and second indicators to become altered such that the signal is produced.

87. The system of claim 1, wherein the particle comprises a biopolymer coupled to a polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the particle further comprises a first indicator and a second indicator, the first and second indicators being coupled to the biopolymer, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes a distance between the first and second indicators to become altered such that the signal is produced, and wherein the first indicator is a fluorescent dye and wherein the second indicator is a fluorescent quencher, and wherein the first indicator and the second indicator are within the Föster energy transfer radius, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes the first and second indicators to move outside the Föster energy transfer radius.

88. The system of claim 1, wherein the particle comprises a biopolymer coupled to a polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the particle further comprises a first indicator and a second indicator, the first and second indicators being coupled to the biopolymer, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes a distance between the first and second indicators to become altered such that the signal is produced. wherein the first indicator is a fluorescent dye and wherein the second indicator is a different fluorescent dye, and wherein the first indicator and the second indicator produce a fluorescence resonance energy transfer signal, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes the positions of the first and second indicators to change such that the fluorescence resonance energy transfer signal is altered.

89. The system of claim 1, wherein the particle comprises a biopolymer coupled to a polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the

analyte to produce a signal, and further comprising an indicator coupled to the biopolymer, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes the biopolymer to be cleaved such that a portion of the biopolymer coupled to the indicator is cleaved from a portion of the biopolymer coupled to the polymeric resin.

5

90. The system of claim 1 wherein the particle comprises a biopolymer coupled to a polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the particle further comprises an indicator coupled to the particle, and wherein the chemical reaction causes a change to a biopolymer such that the interaction of the indicator with the biopolymer is altered to produce the signal.

10

91. The system of claim 1, wherein the particle comprises a biopolymer coupled to a polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the particle further comprises an indicator coupled to the particle, and wherein the chemical reaction causes a change to the biopolymer and the indicator to produce the signal.

15  
20

92. The system of claim 1, wherein the particle comprises a receptor coupled to a polymeric resin, and a probe molecule coupled to the polymeric resin, and wherein the probe molecule is configured to produce a signal when the receptor interacts with the analyte during use.

25

93. The system of claim 1, wherein the particle comprises a receptor coupled to a polymeric resin, and a probe molecule coupled to the polymeric resin, and wherein the probe molecule is configured to produce a signal when the receptor interacts with the analyte during use, and wherein the particles further comprises an additional probe molecule coupled to the polymeric resin, wherein the interaction of the receptor with the analyte causes the probe molecules to interact such that the signal is produced.

94. A system for detecting an analyte in a fluid comprising:

5

a light source;

a sensor array, the sensor array comprising:

10

a supporting member; wherein a first cavity and a second cavity are formed within the supporting member;

a first particle positioned within the first cavity;

15  
20  
25

a second particle positioned within the second cavity, wherein the second particle comprises a reagent, wherein a portion of the reagent is removable from the second particle when contacted with a decoupling solution, and wherein the reagent is configured to modify the first particle, when the reagent is contacted with the first particle, such that the first particle will produce a signal when the first particle interacts with the analyte during use;

a first pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the first cavity;

a second pump coupled to the supporting member, wherein the second pump is configured to direct the decoupling solution towards the second cavity;

wherein a first channel is formed in the supporting member, the first channel coupling the first pump to the first cavity such that the fluid flows through the first channel to the first cavity during use, and wherein a second channel is formed in the supporting member, the second channel coupling the second cavity to the first cavity such that the decoupling solution flows from the second cavity through the second channel to the first cavity during use; and

a detector, the detector being configured to detect the signal produced by the interaction of the analyte with the particle during use;

5       wherein the light source and detector are positioned such that light passes from the light source, to the particle, and onto the detector during use.

95. The system of claim 94, wherein the sensor array further comprises a plurality of additional particles positioned within a plurality of additional cavities, and wherein the system is  
10      configured to substantially simultaneously detect a plurality of analytes in the fluid, and wherein the second cavity is coupled to the additional cavities such that the reagent may be transferred from the second particle to the additional cavities during use.

96. The system of claim 94, wherein the first particle comprises an indicator molecule coupled to a first polymeric resin, and the second particle comprises a receptor molecule coupled to a second polymeric resin.  
5

97. The system of claim 94, wherein the first particle comprises a first polymeric resin configured to bind to the receptor molecule, and wherein the second particle comprises the receptor molecule coupled to a second polymeric resin.  
20

98. The system of claim 94, wherein the sensor array further comprises a reservoir coupled to the second pump, the reservoir configured to hold the decoupling solution.

25      99. A system for detecting an analyte in a fluid comprising:

          a light source;

          a sensor array, the sensor array comprising at least one particle coupled to the sensor

array, wherein the particle is configured to produce a signal when the particle interacts with the analyte; and

5           a detector configured to detect the signal produced by the interaction of the analyte with the particle;

wherein the light source and detector are positioned such that light passes from the light source, to the particle, and onto the detector during use.

10       100. A sensor array for detecting an analyte in a fluid comprising:

15           a supporting member; wherein at least one cavity is formed within the supporting member;

a particle positioned within the cavity, wherein the particle is configured to produce a signal when the particle interacts with the analyte.

20       101. The sensor array of claim 100, further comprising a plurality of particles positioned within the cavity.

102. The sensor array of claim 100, wherein the particle comprises a receptor molecule coupled to a polymeric resin.

25       103. The sensor array of claim 100, wherein the particle has a size ranging from about 0.05 micron to about 500 microns in diameter.

104. The sensor array of claim 100, wherein the particle has a size ranging from about 0.05 micron to about 500 microns in diameter, and wherein the cavity is configured to substantially contain the particle.

105. The sensor array of claim 100, wherein the supporting member comprises a plastic material.
- 5 106. The sensor array of claim 100, wherein the supporting member comprises a silicon wafer.
107. The sensor array of claim 100, wherein the cavity extends through the supporting member.
- 10 108. The sensor array of claim 100, wherein the supporting member comprises a silicon wafer, and wherein the cavity is substantially pyramidal in shape and wherein the sidewalls of the cavity are substantially tapered at an angle of between about 50 to about 60 degrees.
- 15 109. The sensor array of claim 100, wherein the supporting member comprises a silicon wafer, and further comprising a substantially transparent layer positioned on a bottom surface of the silicon wafer.
- 20 110. The sensor array of claim 100, wherein the supporting member comprises a silicon wafer, and further comprising a substantially transparent layer positioned on a bottom surface of the silicon wafer, wherein the substantially transparent layer comprises silicon dioxide, silicon nitride, or silicon oxide/silicon nitride multilayer stacks.
- 25 111. The sensor array of claim 100, wherein the supporting member comprises a silicon wafer, and further comprising a substantially transparent layer positioned on a bottom surface of the silicon wafer, wherein the substantially transparent layer comprises silicon nitride.
112. The sensor array of claim 100, wherein the supporting member comprises a silicon wafer, and wherein the silicon wafer has an area of about 1 cm<sup>2</sup> to about 100 cm<sup>2</sup>.

113. The sensor array of claim 100, further comprising a plurality of cavities formed in the silicon wafer, and wherein from about 10 to about  $10^6$  cavities are formed in the silicon wafer.

5 114. The sensor array of claim 100, further comprising channels in the supporting member, wherein the channels are configured to allow the fluid to flow through the channels into and away from the cavity.

10 115. The sensor array of claim 100, further comprising an inner surface coating, wherein the inner surface coating is configured to inhibit dislodgment of the particle.

116. The sensor array of claim 100, further comprising a detector coupled to the bottom surface of the supporting member, wherein the detector is positioned below the cavity.

15 117. The sensor array of claim 100, further comprising a detector coupled to the bottom surface of the supporting member, wherein the detector is positioned below the cavity, and wherein the detector is a semiconductor based photodetector.

20 118. The sensor array of claim 100, further comprising a detector coupled to the bottom surface of the supporting member, wherein the detector is positioned below the cavity, and wherein the detector is a Fabry-Perot type detector.

25 119. The sensor array of claim 100, further comprising a detector coupled to the bottom surface of the supporting member, wherein the detector is positioned below the cavity, and further comprising an optical fiber coupled to the detector, wherein the optical fiber is configured to transmit optical data to a microprocessor.

120. The sensor array of claim 100, further comprising an optical filters coupled to a bottom surface of the sensor array.

121. The sensor array of claim 100, further comprising a barrier layer positioned over the cavity, the barrier layer being configured to inhibit dislodgment of the particle during use.

5 122. The sensor array of claim 100, further comprising a barrier layer positioned over the cavity, the barrier layer being configured to inhibit dislodgment of the particle during use, and wherein the barrier layer comprises a substantially transparent cover plate positioned over the cavity, and wherein the cover plate is positioned a fixed distance over the cavity such that the fluid can enter the cavity.

10

123. The sensor array of claim 100, further comprising a barrier layer positioned over the cavity, the barrier layer being configured to inhibit dislodgment of the particle during use, and wherein the barrier layer comprises a substantially transparent cover plate positioned over the cavity, and wherein the cover plate is positioned a fixed distance over the cavity such that the fluid can enter the cavity, and wherein the barrier layer comprises plastic, glass, quartz, silicon oxide, or silicon nitride.

15  
20

124. The sensor array of claim 100, further comprising a plurality of particles positioned within a plurality of cavities formed in the supporting member.

125. The sensor array of claim 100, wherein the system comprises a plurality of particles positioned within a plurality of cavities, and wherein the plurality of particles produce a detectable pattern in the presence of the analyte.

25 126. The sensor array of claim 100, further comprising channels in the supporting member, wherein the channels are configured to allow the fluid to flow through the channels into and away from the cavities, and wherein the barrier layer comprises a cover plate positioned upon an upper surface of the supporting member, and wherein the cover plate inhibits passage of the fluid into the cavities such that the fluid enters the cavities via the channels.

127. The sensor array of claim 100, further comprising a cover layer coupled to the supporting member and a bottom layer coupled to the supporting member, wherein the bottom layer is coupled to a bottom surface of the supporting member and wherein the cover layer is removable, and wherein the cover layer and the bottom layer include openings that are substantially aligned with the cavities during use.

5

128. The sensor array of claim 100, further comprising a cover layer coupled to the supporting member and a bottom layer coupled to the supporting member, wherein an opening is formed in the cover layer substantially aligned with the cavity, and wherein an opening is formed in the bottom layer substantially aligned with the cavity.

10

129. The sensor array of claim 100, wherein the cavity is substantially tapered such that the width of the cavity narrows in a direction from a top surface of the supporting member toward a bottom surface of the supporting member, and wherein a minimum width of the cavity is substantially less than a width of the particle.

15

130. The sensor array of claim 100, wherein a width of a bottom portion of the cavity is substantially less than a width of a top portion of the cavity, and wherein the width of the bottom portion of the cavity is substantially less than a width of the particle.

20

131. The sensor array of claim 100, further comprising a cover layer coupled to the supporting member and a bottom layer coupled to the supporting member, wherein the bottom layer is configured to support the particle, and wherein an opening is formed in the cover layer substantially aligned with the cavity.

25

132. The sensor array of claim 100, further comprising a removable cover layer coupled to the supporting member.

133. The sensor array of claim 100, wherein the supporting member comprises a dry film photoresist material.
134. The sensor array of claim 100, wherein the supporting member comprises a plurality of 5 layers of a dry film photoresist material.
135. The sensor array of claim 100, wherein an inner surface of the cavity is coated with a reflective material.
- 10 136. The sensor array of claim 100, further comprising channels in the supporting member, wherein the channels are configured to allow the fluid to flow through the channels into and away from the cavity.
- 15 137. The sensor array of claim 100, further comprising a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity; and a channel formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use.
- 20 138. The sensor array of claim 100, further comprising a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity; and a channel formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises a diaphragm pump.
- 25 139. The sensor array of claim 100, further comprising a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity; and a channel formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises an electrode pump.

140. The sensor array of claim 100, further comprising a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity; and a channel formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises a piezoelectric pump.

141. The sensor array of claim 100, further comprising a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity; and a channel formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises a pneumatic activated pump.

142. The sensor array of claim 100, further comprising a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity; and a channel formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises a heat activated pump.

143. The sensor array of claim 100, further comprising a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity; and a channel formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises a peristaltic pump.

144. The sensor array of claim 100, further comprising a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity; and a channel formed in the supporting member, the channel coupling the pump to the cavity such that the

fluid flows through the channel to the cavity during use, and wherein the pump comprises an electroosmosis pump.

145. The sensor array of claim 100, further comprising a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity; and a channel formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises an electrohydrodynamic pump.

146. The sensor array of claim 100, further comprising a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity; and a channel formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises an electroosmosis pump and an electrohydrodynamic pump.

147. The sensor array of claim 100, wherein a width of a bottom portion of the cavity is substantially less than a width of a top portion of the cavity, and wherein the width of the bottom portion of the cavity is substantially less than a width of the particle.

148. A sensor array for detecting an analyte in a fluid comprising:

a supporting member; wherein a first cavity and a second cavity are formed within the supporting member;

a first particle positioned within the first cavity;

a second particle positioned within the second cavity, wherein the second particle comprises a reagent, wherein a portion of the reagent is removable from the second

particle when contacted with a decoupling solution, and wherein the reagent is configured to modify the first particle, when the reagent is contacted with the first particle, such that the first particle will produce a signal when the first particle interacts with the analyte during use;

5

a first pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the first cavity;

10

a second pump coupled to the supporting member, wherein the second pump is configured to direct the decoupling solution towards the second cavity;

USPTO-20190315-A1

wherein a first channel is formed in the supporting member, the first channel coupling the first pump to the first cavity such that the fluid flows through the first channel to the first cavity during use, and wherein a second channel is formed in the supporting member, the second channel coupling the second cavity to the first cavity such that the decoupling solution flows from the second cavity through the second channel to the first cavity during use.

149. The sensor array of claim 148, wherein the first particle comprises a receptor molecule coupled to a first polymeric resin, and wherein the second particle comprises an indicator molecule coupled to a second polymeric resin.

20

150. The sensor array of claim 148, wherein the first particle comprises an indicator molecule coupled to a first polymeric resin, and the second particle comprises a receptor molecule coupled to a second polymeric resin.

25

151. The sensor array of claim 148, wherein the first particle comprises a first polymeric resin configured to bind to the receptor molecule, and wherein the second particle comprises the receptor molecule coupled to a second polymeric resin.

152. The sensor array of claim 148, further comprising a reservoir coupled to the second pump, the reservoir configured to hold the decoupling solution.

5 153. A sensor array for detecting an analyte in a fluid comprising:

at least one particle coupled to a supporting member, wherein the particle is configured to produce a signal when the particle interacts with the analyte.

10 154. The sensor array of claim 153, wherein the particle is coupled to the supporting member with via an adhesive material.

155. The sensor array of claim 153, wherein the particle are coupled to the supporting member via a gel material.

156. The sensor array of claim 153, wherein the particle is suspended in a gel material, the gel material covering a portion of the supporting member, and wherein a portion of the particle extends from the upper surface of the gel.

157. The sensor array of claim 153, further comprising a cover positioned above the particle.

158. The sensor array of claim 153, further comprising a cover coupled to the supporting member, positioned above the particle, wherein a force exerted by the cover on the particle inhibits the displacement of the particle from the supporting member.

25 159. The sensor array of claim 153, wherein the particle comprises a receptor molecule coupled to a polymeric resin.

160. The sensor array of claim 153, wherein the supporting member comprises glass.

161. A method for forming a sensor array configured to detect an analyte in a fluid, comprising:

5 forming a cavity in a supporting member, wherein the supporting member comprises a silicon wafer;

placing a particle in the cavity, wherein the particle is configured to produce a signal when the particle interacts with the analyte; and

10 forming a cover upon a portion of the supporting member, wherein the cover is configured to inhibit dislodgment of the particle from the cavity.

162. The method of claim 161, wherein forming the cavity comprises anisotropically etching the silicon wafer.

163. The method of claim 161, wherein forming the cavity comprises anisotropically etching the silicon wafer with a wet hydroxide etch.

164. The method of claim 161, wherein forming the cavity comprises anisotropically etching the silicon wafer such that sidewalls of the cavity are tapered at an angle from about 50 degrees to about 60 degrees.

165. The method of claim 161, wherein the silicon wafer has an area of about 1 cm<sup>2</sup> to about 25 100 cm<sup>2</sup>.

166. The method of claim 161, further comprising forming a substantially transparent layer upon a bottom surface of the silicon wafer below the cavity.

167. The method of claim 161, further comprising forming a substantially transparent layer upon a bottom surface of the silicon wafer, wherein the cavity extends through the silicon wafer and wherein the substantially transparent layer is positioned to support the particle.

5 168. The method of claim 161, wherein the substantially transparent layer comprises silicon nitride.

169. The method of claim 161, wherein the cover comprises plastic, glass, quartz, silicon nitride, or silicon oxide.

10

170. The method of claim 161, wherein forming the cover comprises coupling the cover to the silicon wafer at a distance above the silicon wafer substantially less than a width of the particle.

171. The method of claim 161, further comprising etching channels in the silicon wafer prior to forming the cover on the silicon wafer, wherein forming the cover comprises placing the cover against the upper surface of the silicon wafer, and wherein the channels are configured to allow the fluid to pass through the silicon wafer to and from the cavities.

20 172. The method of claim 161, further comprising coating an inner surface of the cavity with a material to increase adhesion of the particle to the inner surface of the cavity.

173. The method of claim 161, further comprising coating an inner surface of the cavity with a material to increase reflectivity of the inner surface of the cavity.

25

174. The method of claim 161, further comprising forming an optical detector upon a bottom surface of the supporting member below the cavity.

175. The method of claim 161, further comprising forming a sensing cavity upon a bottom

surface of the supporting member below the cavity.

176. The method of claim 161, further comprising forming a sensing cavity upon a bottom surface of the supporting member below the cavity, and wherein forming the sensing cavity comprises:

5 forming a barrier layer upon a bottom surface of the silicon wafer;

10 forming a bottom diaphragm layer upon the barrier layer;

15 forming etch windows extending through the bottom diaphragm layer;

20 forming a sacrificial spacer layer upon the bottom diaphragm layer;

25 removing a portion of the spacer layer;

removing a remaining portion of the spacer layer.

177. The method of claim 161, further comprising forming an optical filter upon the bottom surface of the supporting member.

178. The method of claim 161, further comprising forming a plurality of cavities in the silicon 25 wafer.

179. The method of claim 161, wherein from about 10 to about  $10^6$  cavities are formed in the silicon wafer.

180. The method of claim 161, wherein the formed cavity is configured to allow the fluid to pass through the supporting member.

181. The method of claim 161, further comprising forming a substantially transparent layer  
5 upon a bottom surface of the supporting member below the cavity, wherein the bottom layer is configured to inhibit the displacement of the particle from the cavity while allowing the fluid to pass through the supporting member.

182. The system of claim 161, wherein a width of a bottom portion of the cavity is  
10 substantially less than a width of a top portion of the cavity, and wherein the width of the bottom portion of the cavity is substantially less than a width of the particle.

183. The method of claim 161, further comprising forming channels in the supporting member  
wherein the channels are configured to allow the fluid to pass through the supporting member  
5 to and from the cavity.

184. The method of claim 161, further comprising forming a pump on the supporting member,  
the pump being configured to pump the fluid to the cavity.

185. The method of claim 161, further comprising forming a cover, wherein forming the cover  
20 comprises:

forming a removable layer upon the upper surface of the supporting member;

25 forming a cover upon the removable layer;

forming support structures upon the supporting member, the support structures  
covering a portion of the cover; and

dissolving the removable layer.

186. The method of claim 161, wherein forming the cover further comprises forming openings in the cover, wherein the openings are substantially aligned with the cavity.

5

187. The method of claim 161, wherein the particles are placed in the cavities using a micromanipulator.

188. The method of claim 161, further comprising forming additional cavities within the supporting member, and further comprising placing additional particles in the additional cavities, wherein placing the additional particles in the additional cavities comprises:

10 placing a first masking layer on the supporting member, wherein the first masking layer covers a first portion of the additional cavities such that passage of a particle into the first portion of the additional cavities is inhibited, and wherein the first masking layer a second portion of the cavities substantially unmasked,;

15 placing the additional particles on the supporting member;

20 moving the additional particles across the supporting member such that the particles fall into the second portion of the cavities;

25 removing the first masking layer;

placing a second masking layer upon the supporting member, wherein the second masking layer covers the second portion of the cavities and a portion of the first portion of the cavities while leaving a third portion of the cavities unmasked;

placing additional particles on the supporting member; and

moving the additional particles across the supporting member such that the particle fall into the third portion of the cavities.

5 189. The method of claim 161, wherein forming the cover comprises coupling the cover to the supporting member at a distance above the supporting member substantially less than a width of the particle.

10 190. The method of claim 161, wherein the supporting member comprises a dry film photoresist material.

191. The method of claim 161, wherein the supporting member comprises a plurality of layers of a dry film photoresist material.

192. The method of claim 161, wherein forming the cavity comprises:

15 etching a first opening through a first dry film photoresist layer, the first opening having a width substantially less than a width of the particle;

20 placing a second dry film photoresist layer upon the first dry film photoresist layer;

etching a second opening through the second dry film photoresist layer, the second opening being substantially aligned with the first opening, wherein a width of the second opening is substantially greater than the width of the first opening;

25 wherein the second dry film photoresist layer comprises a thickness substantially greater than a width of the particle;

and further comprising forming a reflective layer upon the inner surface of the cavity.

193. The method of claim 161, wherein the supporting material comprises a plastic material.
194. The method of claim 161, wherein the supporting material comprises a plastic material,  
5 and wherein the cavity is formed by drilling the supporting material.
195. The method of claim 161, wherein the supporting material comprises a plastic material,  
and wherein the cavity is formed by transfer molding the supporting member.
- 10 196. The method of claim 161, wherein the supporting material comprises a plastic material,  
and wherein the cavity is formed by a punching device.
197. A method of sensing an analyte in a fluid comprising:  
  
passing a fluid over a sensor array, the sensor array comprising at least one particle  
positioned within a cavity of a supporting member;  
  
monitoring a spectroscopic change of the particle as the fluid is passed over the sensor  
array, wherein the spectroscopic change is caused by the interaction of the analyte  
with the particle.  
20
198. The method of claim 197, wherein the spectroscopic change comprises a change in  
absorbance of the particle.
- 25 199. The method of claim 197, wherein the spectroscopic change comprises a change in  
fluorescence of the particle.
200. The method of claim 197, wherein the spectroscopic change comprises a change in  
phosphorescence of the particle.

201. The method of claim 197, wherein the analyte is a proton atom, and wherein the spectroscopic change is produced when the pH of the fluid is varied, and wherein monitoring the spectroscopic change of the particle allows the pH of the fluid to be determined.

5

202. The method of claim 197, wherein the analyte is a metal cation, and wherein the spectroscopic change is produced in response to the presence of the metal cation in the fluid.

203. The method of claim 197, wherein the analyte is an anion, and wherein the spectroscopic

10 change is produced in response to the presence of the anion in the fluid.

204. The method of claim 197, wherein the analyte is a DNA molecule, and wherein the spectroscopic change is produced in response to the presence of the DNA molecule in the fluid.

205. The method of claim 197, wherein the analyte is a protein, and wherein the spectroscopic change is produced in response to the presence of the protein in the fluid.

206. The method of claim 197, wherein the analyte is a metabolite, and wherein the spectroscopic change is produced in response to the presence of the metabolite in the fluid.

207. The method of claim 197, wherein the analyte is a sugar, and wherein the spectroscopic change is produced in response to the presence of the sugar in the fluid.

208. The method of claim 197, wherein the analyte is a bacteria, and wherein the spectroscopic change is produced in response to the presence of the bacteria in the fluid.

209. The method of claim 197, wherein the particle comprises a receptor coupled to a polymeric resin, and further comprising exposing the particle to an indicator prior to passing

the fluid over the sensor array.

210. The method of claim 197, wherein the particle comprises a receptor coupled to a  
polymeric resin, and further comprising exposing the particle to an indicator prior to passing  
5 the fluid over the sensor array, and wherein a binding strength of the indicator to the receptor  
is less than a binding strength of the analyte to the receptor.

10 211. The method of claim 197, wherein the particle comprises a receptor coupled to a  
polymeric resin, and further comprising exposing the particle to an indicator prior to passing  
the fluid over the sensor array, and wherein the indicator is a fluorescent indicator.

212. The method of claim 197, further comprising treating the fluid with an indicator prior to  
passing the fluid over the sensor array, wherein the indicator is configured to couple with the  
analyte.  
25

213. The method of claim 197, wherein the analyte is bacteria and further comprising breaking  
down the bacteria prior to passing the fluid over the sensor array.

20 214. The method of claim 197, wherein monitoring the spectroscopic change is performed  
with a CCD device.

25 215. The method of claim 197, further comprising measuring the intensity of the spectroscopic  
change, and further comprising calculating the concentration of the analyte based on the  
intensity of the spectroscopic change.

216. The method of claim 197, wherein the supporting member comprises silicon.

217. The method of claim 197, wherein the spectroscopic change comprises a change in  
reflectance of the particle.

218. The method of claim 197, wherein the cavity is configured such that the fluid entering the cavity passes through the supporting member.

5 219. The method of claim 197, wherein monitoring the spectroscopic change comprises:

directing a red light source at the particle;

detecting the absorbance of red light by the particle;

10

directing a green light source at the particle;

detecting the absorbance of green light by the particle;

15 directing a blue light source at the particle; and

detecting the absorbance of blue light by the particle.

220. The method of claim 197, wherein the sensor array further comprises a vacuum chamber  
20 coupled to a conduit and the sensor array , and wherein the chamber is configured to provide  
a pulling force on the fluid in the sensor array.

221. The method of claim 197, wherein the fluid is blood.

25 222. The method of claim 197, further comprising passing the fluid through a filter prior to  
passing the fluid over the sensor array.

223. The method of claim 197, further comprising passing the fluid through a reagent reservoir  
prior to passing the fluid over the sensor array.

224. The method of claim 197, wherein the particles are initially stored in a buffer, and further comprising removing the buffer prior to passing the fluid over the sensor array.
- 5 225. The method of claim 197, wherein the particle comprises a polymeric resin, a biopolymer coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal.
- 10 226. The method of claim 197, wherein the particle comprises a polymeric resin, a biopolymer coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the signal comprises an absorbance of the particle.
- 15 227. The method of claim 197, wherein the particle comprises a polymeric resin, a biopolymer coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the signal comprises a fluorescence of the particle.
- 20 228. The method of claim 197, wherein the particle comprises a polymeric resin, a biopolymer coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the signal comprises a phosphorescence of the particle.
- 25 229. The method of claim 197, wherein the particle comprises a polymeric resin, a biopolymer coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the chemical reaction comprises cleavage of the biopolymer induced by the analyte.
230. The method of claim 197, wherein the particle comprises a polymeric resin, a biopolymer

coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the biopolymer comprises a peptide, and wherein the analyte comprises a protease, and wherein the chemical reaction comprises cleavage of the peptide by the protease.

5

231. The method of claim 197, wherein the particle comprises a polymeric resin, a biopolymer coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the biopolymer comprises a polynucleotide, and wherein the analyte comprises a nuclease, and wherein the chemical reaction comprises cleavage of the polynucleotide by the nuclease.

10

232. The method of claim 197, wherein the particle comprises a polymeric resin, a biopolymer coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the biopolymer comprises an oligosaccharide, and wherein the analyte comprises an oligosaccharide cleaving agent, and wherein the chemical reaction comprises cleavage of the oligosaccharide by the oligosaccharide cleaving agent.

233. The method of claim 197, wherein the particle comprises a polymeric resin, a biopolymer coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the particle further comprises a first indicator and a second indicator, the first and second indicators being coupled to the biopolymer, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes a distance between the first and second indicators to become altered such that the alteration of the signal is produced.

25

234. The method of claim 197, wherein the particle comprises a polymeric resin, a biopolymer coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the particle further comprises a

first indicator and a second indicator, the first and second indicators being coupled to the biopolymer, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes a distance between the first and second indicators to become altered such that the alteration of the signal is produced, and wherein the first indicator is a fluorescent dye and wherein the second indicator is a fluorescent quencher, and wherein the first indicator and the second indicator are within the Föster energy transfer radius, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes the first and second indicators to move outside the Föster energy transfer radius such that the alteration of the signal is produced.

5

10

235. The method of claim 197, wherein the particle comprises a polymeric resin, a biopolymer coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the particle further comprises a first indicator and a second indicator, the first and second indicators being coupled to the biopolymer, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes a distance between the first and second indicators to become altered such that the alteration of the signal is produced, and wherein the first indicator is a fluorescent dye and wherein the second indicator is a different fluorescent dye, and wherein the first indicator and the second indicator produce a fluorescence resonance energy transfer signal, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes the positions of the first and second indicators to change such that the fluorescence resonance energy transfer signal is altered producing the alteration in the signal.

20

25

236. The method of claim 197, wherein the particle comprises a polymeric resin, a biopolymer coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and further comprising an indicator coupled to the biopolymer, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes the biopolymer to be cleaved such that a portion of the biopolymer coupled to the indicator is cleaved from a portion of the biopolymer coupled to the polymeric resin.

237. The method of claim 197, wherein the particle comprises a receptor coupled to a polymeric resin, and a probe molecule coupled to the polymeric resin, and wherein the probe molecule is configured to produce a signal when the receptor interacts with the analyte during use.

5

238. The method of claim 197, wherein the particle comprises a receptor and an indicator coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the receptor interacts with the analyte during use.

10

239. The method of claim 197, wherein the particle comprises a receptor and an indicator coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the receptor interacts with the analyte during use, and wherein the receptor is coupled to the polymeric resin by a first linker and wherein the indicator is coupled to the polymeric resin by a second linker.

15

240. The method of claim 197, wherein the particle comprises a receptor and an indicator coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the receptor interacts with the analyte during use, and wherein the receptor is coupled to the polymeric resin by a first linker and wherein the indicator is coupled to the polymeric resin by a second linker, and wherein the particle further comprises an additional indicator coupled to the polymeric resin by a third linker, wherein the interaction of the receptor with the analyte causes the indicator and the additional indicator to interact such that the signal is produced.

20

241. The method of claim 197, wherein the particle comprises a receptor and an indicator coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the receptor interacts with the analyte during use, and wherein the receptor is coupled to the polymeric resin by a first linker and wherein the indicator is coupled to the receptor.

25

242. The method of claim 197, wherein the particle comprises a receptor and an indicator coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the receptor interacts with the analyte during use, and wherein the receptor is coupled to the polymeric resin by a first linker and wherein the indicator is coupled to the receptor, and wherein the particle further comprises an additional indicator coupled to the receptor, 5 wherein the interaction of the receptor with the analyte causes the indicator and the additional indicator to interact such that the signal is produced.

243. The method of claim 197, wherein the particle comprises a receptor and an indicator 10 coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the receptor interacts with the analyte during use, and wherein the receptor is coupled to the polymeric resin by a first linker and wherein the indicator is coupled to the receptor by a second linker.

244. The method of claim 197, wherein the particle comprises a receptor and an indicator 15 coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the receptor interacts with the analyte during use, and wherein the receptor is coupled to the polymeric resin by a first linker and wherein the indicator is coupled to the receptor by a second linker, and wherein the particle further comprises an additional indicator coupled to the receptor, wherein the interaction of the receptor with the analyte causes the indicator and 20 the additional indicator to interact such that the signal is produced.

245. The method of claim 197, wherein the particle comprises a receptor and an indicator 25 coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the receptor interacts with the analyte during use, and wherein the receptor is coupled to the polymeric resin by a first linker and wherein the indicator is coupled to the first linker.

246. The method of claim 197, wherein the particle comprises a receptor and an indicator coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the

receptor interacts with the analyte during use, and wherein the receptor is coupled to the polymeric resin by a first linker, and wherein the indicator is coupled to the first linker by a second linker.

- 5 247. The method of claim 197, wherein the particle comprises a receptor and an indicator  
coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the  
receptor interacts with the analyte during use, and wherein the receptor is coupled to the  
polymeric resin by a first linker, and wherein the indicator is coupled to the first linker by a  
second linker, and wherein the particle further comprises an additional indicator coupled to  
10 the receptor, wherein the interaction of the receptor with the analyte causes the indicator and  
the additional indicator to interact such that the signal is produced.
248. The method of claim 197, wherein the particle comprises a receptor and an indicator  
coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the  
receptor interacts with the analyte during use, and wherein the receptor is coupled to the  
polymeric resin by a first linker, and wherein the indicator is coupled to the first linker by a  
second linker, and wherein the particle further comprises an additional indicator coupled to  
the first linker by a third linker, wherein the interaction of the receptor with the analyte causes  
the indicator and the additional indicator to interact such that the signal is produced.
249. The method of claim 197, wherein the particle comprises a receptor and an indicator  
coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the  
receptor interacts with the analyte during use, and wherein the indicator interacts with the  
receptor in the absence of an analyte.
250. The method of claim 197, wherein the particle comprises a receptor and an indicator  
coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the  
receptor interacts with the analyte during use, and wherein the particle further comprises an  
additional indicator coupled to the polymeric resin, and wherein the indicator is a first

fluorescent dye and wherein the additional indicator is a second fluorescent dye, and wherein the indicator and the additional indicator produce a fluorescence resonance energy transfer signal, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the fluorescence resonance energy transfer signal is altered.

5

251. The method of claim 197, wherein the particle comprises a receptor and an indicator coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the receptor interacts with the analyte during use, and wherein the particle further comprises an additional indicator coupled to the polymeric resin, wherein the indicator is a fluorescent dye and wherein the additional indicator is a fluorescence quencher, and wherein the indicator and the additional indicator are positioned such that the fluorescence of the indicator is at least partially quenched by the additional indicator, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the quenching of the fluorescence of the indicator by the additional indicator is altered.

10

15

20

252. The method of claim 197, wherein the particle comprises a biopolymer coupled to a polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte such that the signal is altered.

253. A particle for detecting an analyte in a fluid comprising:

25

a polymeric resin;

a biopolymer coupled to the polymeric resin; and

an indicator system coupled to the biopolymer, the indicator system producing a

signal, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte such that the signal is altered.

254. The particle of claim 253, wherein the particle ranges from about 0.05 micron to about

5 500 microns.

255. The particle of claim 253, wherein a volume of the particle changes when contacted with the fluid.

10 256. The particle of claim 253, wherein the chemical reaction comprises cleavage of the biopolymer by the analyte.

15 257. The particle of claim 253, wherein the biopolymer comprises a peptide, and wherein the analyte comprises a protease, and wherein the chemical reaction comprises cleavage of the peptide by the protease.

20 258. The particle of claim 253, wherein the biopolymer comprises a polynucleotide, and wherein the analyte comprises a nuclease, and wherein the chemical reaction comprises cleavage of the polynucleotide by the nuclease.

259. The particle of claim 253, wherein the biopolymer comprises an oligosaccharide, and wherein the analyte comprises an oligosaccharide cleaving agent, and wherein the chemical reaction comprises cleavage of the oligosaccharide by the oligosaccharide cleaving agent.

25 260. The particle of claim 253, wherein the particle indicator system comprises a first indicator and a second indicator, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes a distance between the first and second indicators to become altered such that the signal is produced.

261. The particle of claim 253, wherein the first indicator is a fluorescent dye and wherein the second indicator is a fluorescent quencher, and wherein the first indicator and the second indicator are within the Förster energy transfer radius, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes the first and second indicators to move outside the Förster energy transfer radius.

5

262. The particle of claim 253, wherein the first indicator is a fluorescent dye and wherein the second indicator is a different fluorescent dye, and wherein the first indicator and the second indicator produce a fluorescence resonance energy transfer signal, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes the positions of the first and second indicators to change such that the fluorescence resonance energy transfer signal is altered.

10

263. The particle of claim 253, wherein the indicator system comprises at least one indicator coupled to the biopolymer, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes the biopolymer to be cleaved such that a portion of the biopolymer coupled to the indicator is cleaved from a portion of the biopolymer coupled to the polymeric resin.

15

264. A particle for detecting an analyte in a fluid comprising:

20

a polymeric resin;

a receptor coupled to the polymeric resin; and

25

a probe molecule coupled to the biopolymer, the probe molecule configured to produce a signal when the receptor interacts with the analyte during use.

265. The particle of claim 264, wherein the analyte comprises a metal ion, and wherein the

probe molecule produces the signal in response to the interaction of the metal ion with the receptor.

266. The particle of claim 264, wherein the particles further comprises an additional probe  
5 molecule coupled to the polymeric resin, wherein the interaction of the receptor with the analyte causes the probe molecules to interact such that the signal is produced.

267. The particle of claim 264, wherein the receptor comprises a polynucleotide.

10 268. The particle of claim 264, wherein the receptor comprises a peptide.

269. The particle of claim 264, wherein the receptor comprises an enzyme.

270. The particle of claim 264, wherein the receptor comprises a synthetic receptor.

271. The particle of claim 264, wherein the receptor comprises an unnatural biopolymer.

272. The particle of claim 264, wherein the receptor comprises an antibody.

20 273. The particle of claim 264, wherein the receptor comprises an antigen.

274. The particle of claim 264, wherein the analyte comprises phosphate functional groups, and wherein the particle is configured to produce the signal in the presence of the phosphate functional groups.

25 275. The particle of claim 264, wherein the analyte comprises bacteria, and wherein the particle is configured to produce the signal in the presence of the bacteria.

276. The particle of claim 264, wherein the receptor comprises an antibody, an aptamer, an

organic receptor, or an enzyme.

277. The particle of claim 264, wherein the probe molecule comprises an indicator, a dye, a quantum particle, or a semi-conductor particle.

5

278. A particle for detecting an analyte in a fluid comprising:

a polymeric resin;

10

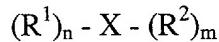
a receptor coupled to the polymeric resin by a first linker; and

an indicator coupled to the first linker, the indicator configured to produce a signal when the receptor interacts with the analyte during use.

279. The particle of claim 278, wherein the receptor comprises a polynucleotide.

280. The particle of claim 278, wherein the receptor comprises a peptide.

281. The particle of claim 278, wherein the receptor comprises a compound of the general formula:



25

wherein X comprises carbocyclic systems or C<sub>1</sub>-C<sub>10</sub> alkanes, n is an integer of at least 1, m is an integer of at least 1; and

wherein each of R<sup>1</sup> independently represents -(CH<sub>2</sub>)<sub>y</sub>-NR<sup>3</sup>-C(NR<sup>4</sup>)-NR<sup>5</sup>, -(CH<sub>2</sub>)<sub>y</sub>-NR<sup>6</sup>R<sup>7</sup>, -(CH<sub>2</sub>)<sub>y</sub>-NH-Y, -(CH<sub>2</sub>)<sub>y</sub>-O-Z;  
where y is an integer of at least 1;

where R<sup>3</sup>, R<sup>4</sup>, and R<sup>5</sup> independently represent hydrogen, alkyl, aryl, alkyl carbonyl of 1 to 10 carbon atoms, or alkoxy carbonyl of 1 to 10 carbon atoms, or R<sup>4</sup> and R<sup>5</sup> together represent a cycloalkyl group;

alkoxy carbonyl of 1 to 10 carbon atoms;

where R<sup>7</sup> represents alkyl, aryl, alkyl carbonyl of 1 to 10 carbon atoms, or alkoxy carbonyl of 1 to 10 carbon atoms;

where R<sup>6</sup> and R<sup>7</sup> together represent a cycloalkyl group;

where Y is a peptide, or hydrogen

and where Z is a polynucleotide, an oligosaccharide or hydrogen; and

wherein each of R<sup>2</sup> independently represents hydrogen, alkyl, alkenyl, alkynyl, phenyl, phenylalkyl, arylalkyl, aryl, or together with another R<sup>2</sup> group represent a carbocyclic ring.

282. The particle of claim 278, wherein the receptor comprises an enzyme.

283. The particle of claim 278, wherein the receptor is coupled to the first linker by a second linker and wherein the indicator is coupled to the first linker by a third linker.

284. The particle of claim 278, wherein the receptor is coupled to the first linker by a second linker and wherein the indicator is coupled to the first linker by a third linker, and wherein the indicator interacts with the receptor in the absence of an analyte.

25 285. The particle of claim 278, wherein the particle further comprises an additional indicator  
coupled to the first linker, wherein the interaction of the receptor with the analyte causes the  
indicator and the additional indicator to interact such that the signal is produced.

286. The particle of claim 278, wherein the particle further comprises an additional indicator

coupled to the receptor, wherein the interaction of the receptor with the analyte causes the indicator and the additional indicator to interact such that the signal is produced.

287. The particle of claim 278, wherein the particle further comprises an additional indicator  
5 coupled to the first linker, and wherein the indicator is a first fluorescent dye and wherein the additional indicator is a second fluorescent dye, and wherein the indicator and the additional indicator produce a fluorescence resonance energy transfer signal, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the fluorescence resonance energy transfer signal is  
10 altered.

288. The particle of claim 278, wherein the particle further comprises an additional indicator coupled to the first linker, wherein the indicator is a fluorescent dye and wherein the additional indicator is a fluorescence quencher, and wherein the indicator and the additional indicator are positioned such that the fluorescence of the indicator is at least partially quenched by the additional indicator, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the quenching of the fluorescence of the indicator by the additional indicator is altered.  
15  
20

289. The particle of claim 278, wherein the particle further comprises an additional indicator coupled to the first linker, wherein the indicator is a fluorescence quencher and wherein the additional indicator is a fluorescent dye, and wherein the indicator and the additional indicator are positioned such that the fluorescence of the additional indicator is at least partially quenched by the indicator, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the quenching of the fluorescence of the additional indicator by the indicator is altered.  
25

290. The particle of claim 278, wherein the particle further comprises an additional indicator coupled to the receptor, and wherein the indicator is a first fluorescent dye and wherein the additional indicator is a second fluorescent dye, and wherein the indicator and the additional indicator produce a fluorescence resonance energy transfer signal, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the fluorescence resonance energy transfer signal is altered.

291. The particle of claim 278, wherein the particle further comprises an additional indicator coupled to the receptor, wherein the indicator is a fluorescent dye and wherein the additional indicator is a fluorescence quencher, and wherein the indicator and the additional indicator are positioned such that the fluorescence of the indicator is at least partially quenched by the additional indicator, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the quenching of the fluorescence of the indicator by the additional indicator is altered.

292. The particle of claim 278, wherein the particle further comprises an additional indicator coupled to the receptor, wherein the indicator is a fluorescence quencher and wherein the additional indicator is a fluorescent dye, and wherein the indicator and the additional indicator are positioned such that the fluorescence of the additional indicator is at least partially quenched by the indicator, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the quenching of the fluorescence of the additional indicator by the indicator is altered.

293. The particle of claim 278, wherein the particle further comprises an additional indicator coupled to the first linker, wherein the receptor is coupled to the first linker by a second linker, the indicator is coupled to the first linker by a third linker and the additional indicator is coupled to the first linker by a fourth linker, and wherein the indicator is a first fluorescent

dye and wherein the additional indicator is a second fluorescent dye, and wherein the indicator and the additional indicator produce a fluorescence resonance energy transfer signal, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the fluorescence resonance energy transfer signal is altered.

294. The particle of claim 278, wherein the particle further comprises an additional indicator coupled to the first linker, wherein the receptor is coupled to the first linker by a second linker, the indicator is coupled to the first linker by a third linker and the additional indicator is coupled to the first linker by a fourth linker, wherein the indicator is a fluorescent dye and wherein the additional indicator is a fluorescence quencher, and wherein the indicator and the additional indicator are positioned such that the fluorescence of the indicator is at least partially quenched by the additional indicator, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the quenching of the fluorescence of the indicator by the additional indicator is altered.

295. The particle of claim 278, wherein the particle further comprises an additional indicator coupled to the first linker, wherein the receptor is coupled to the first linker by a second linker, the indicator is coupled to the first linker by a third linker and the additional indicator is coupled to the first linker by a fourth linker, wherein the indicator is a fluorescence quencher and wherein the additional indicator is a fluorescent dye, and wherein the indicator and the additional indicator are positioned such that the fluorescence of the additional indicator is at least partially quenched by the indicator, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the quenching of the fluorescence of the additional indicator by the indicator is altered.

296. The particle of claim 278, wherein the particle further comprises an additional indicator

coupled to the receptor, wherein the receptor is coupled to the first linker by a second linker, the indicator is coupled to the first linker by a third linker and the additional indicator is coupled to the receptor by a fourth linker, and wherein the indicator is a first fluorescent dye and wherein the additional indicator is a second fluorescent dye, and wherein the indicator and the additional indicator produce a fluorescence resonance energy transfer signal, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the fluorescence resonance energy transfer signal is altered.

10 297. The particle of claim 278, wherein the particle further comprises an additional indicator coupled to the receptor, wherein the receptor is coupled to the first linker by a second linker, the indicator is coupled to the first linker by a third linker and the additional indicator is coupled to the receptor by a fourth linker, wherein the indicator is a fluorescent dye and wherein the additional indicator is a fluorescence quencher, and wherein the indicator and the additional indicator are positioned such that the fluorescence of the indicator is at least partially quenched by the additional indicator, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the quenching of the fluorescence of the indicator by the additional indicator is altered.

15 298. The particle of claim 278, wherein the particle further comprises an additional indicator coupled to the receptor, wherein the receptor is coupled to the first linker by a second linker, the indicator is coupled to the first linker by a third linker and the additional indicator is coupled to the receptor by a fourth linker, wherein the indicator is a fluorescent dye and wherein the additional indicator is a fluorescence quencher, and wherein the indicator and the additional indicator are positioned such that the fluorescence of the indicator is at least partially quenched by the additional indicator, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the quenching of the fluorescence of the indicator by the additional indicator

is altered.

299. The particle of claim 278, wherein the particle further comprises an additional indicator coupled to the receptor, wherein the receptor is coupled to the first linker by a second linker, 5 the indicator is coupled to the first linker by a third linker and the additional indicator is coupled to the receptor by a fourth linker, wherein the indicator is a fluorescence quencher and wherein the additional indicator is a fluorescent dye, and wherein the indicator and the additional indicator are positioned such that the fluorescence of the additional indicator is at least partially quenched by the indicator, and wherein the interaction of the analyte with the 10 receptor causes the distance between the indicator and the additional indicator to become altered such that the quenching of the fluorescence of the additional indicator by the indicator is altered.

300. The particle of claim 278, wherein the polymeric resin comprises polystyrene-polyethylene glycol-divinyl benzene.

301. A particle for detecting an analyte in a fluid comprising:

a polymeric resin;

20 a biopolymer coupled to the polymeric resin; and

an indicator system coupled to the biopolymer, the indicator system producing a signal during use, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte such that the signal is altered during use.

25 302. The particle of claim 301, wherein the chemical reaction comprises cleavage of at least a portion of the biopolymer by the analyte.

303. The particle of claim 301, wherein the biopolymer comprises a polynucleotide, and wherein the analyte comprises a nuclease, and wherein the chemical reaction comprises cleavage of at least a portion of the polynucleotide by the nuclease.
- 5 304. The particle of claim 301, wherein the biopolymer comprises an oligosaccharide, and wherein the analyte comprises an oligosaccharide cleaving agent, and wherein the chemical reaction comprises cleavage of at least a portion of the oligosaccharide by the oligosaccharide cleaving agent.
- 10 305. The particle of claim 301, wherein the particle indicator system comprises a first indicator and a second indicator, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes a distance between the first and second indicators to become altered such that the signal is produced.
- 15 306. The particle of claim 689, wherein the first indicator is a fluorescent dye and wherein the second indicator is a fluorescence quencher, and wherein the first indicator and the second indicator are positioned such that the fluorescence of the first indicator is at least partially quenched by the second indicator, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes the first and second indicators to move such that the quenching of the fluorescence of the first indicator by the second indicator is altered.
- 20
307. The particle of claim 689, wherein the first indicator is a fluorescent dye and wherein the second indicator is a different fluorescent dye, and wherein the first indicator and the second indicator produce a fluorescence resonance energy transfer signal, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes the positions of the first and second indicators to change such that the fluorescence resonance energy transfer signal is altered.
- 25
308. The particle of claim 301, wherein the indicator system comprises at least one indicator

coupled to the biopolymer, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes the biopolymer to be cleaved such that at least a portion of the biopolymer coupled to the indicator is cleaved from at least a portion of the biopolymer coupled to the polymeric resin.

5

309. A system for detecting an analyte in a bodily fluid comprising:

a light source;

10

a sensor array, the sensor array comprising a supporting member comprising at least one cavity formed within the supporting member;

15

a particle , the particle positioned within the cavity, wherein the particle is configured to produce a signal when the particle interacts with the analyte in the bodily fluid during use, and wherein the particle comprises a receptor molecule coupled to a polymeric resin; and

20

a detector, the detector being configured to detect the signal produced by the interaction of the analyte with the particle during use;

25

wherein the light source and detector are positioned such that light passes from the light source, to the particle, and onto the detector during use.

310. The system of claim 309, wherein the analyte comprises bacteria, and wherein the receptor molecule comprises an antibody specific for the bacteria in the bodily fluid.

25

311. The system of claim 309, wherein the analyte comprises bacteria, and wherein the receptor molecule comprises an antigen specific for at least one type of antibody in the bodily fluid that is produced in response to the bacteria in the bodily fluid.

312. The system of claim 309, wherein the analyte comprises mastitis bacteria, and wherein  
the receptor molecule comprises an antibody specific for mastitis bacteria.

313. The system of claim 309, wherein the bodily fluid comprises a plurality of bacteria, and  
5 wherein the sensor array includes a plurality of cavities with a plurality of particles, wherein  
each particle comprises a receptor configured to produce a signal in the presence of at least  
one of the bacteria present in the fluid sample.

314. The system of claim 309, wherein the analyte comprises mycobacterium tuberculosis, and  
10 wherein the receptor molecule comprises an antibody specific for mycobacterium  
tuberculosis.

315. The system of claim 309, wherein the analyte comprises a parasite, and wherein the  
receptor molecule comprises an antibody specific for the parasite in the bodily fluid.

316. The system of claim 309, wherein the analyte comprises a parasite, and wherein the  
receptor molecule comprises an antigen specific for at least one type of antibody in the bodily  
fluid that is produced in response to the parasite in the bodily fluid.

20 317. The system of claim 309, wherein the analyte comprises heartworm microfilaria, and  
wherein the receptor molecule comprises an antibody specific for heartworm microfilaria.

318. The system of claim 309, wherein the analyte comprises a virus, and wherein the receptor  
molecule comprises an antibody specific for the virus in the bodily fluid.

25 319. The system of claim 309, wherein the analyte comprises a virus, and wherein the receptor  
molecule comprises an antigen specific for at least one type of antibody in the bodily fluid  
that is produced in response to the virus in the bodily fluid.

320. The system of claim 309, wherein the analyte comprises feline leukemia virus, and wherein the receptor molecule comprises an antibody specific for feline leukemia virus.

321. The system of claim 309, wherein the analyte comprises HIV virus, and wherein the  
5 receptor molecule comprises an antibody specific for HIV virus.

322. The system of claim 309, wherein the analyte comprises hepatitis C virus, and wherein the receptor molecule comprises an antibody specific for hepatitis C virus.

10 323. The system of claim 309, wherein the analyte comprises a carbohydrate, and wherein the receptor molecule is configured to produce the signal in the presence of a carbohydrate.

324. The system of claim 309, wherein the analyte comprises a steroid, and wherein the receptor molecule is configured to produce the signal in the presence of a steroid.

325. The system of claim 309, wherein the analyte comprises a triglyceride, and wherein the receptor molecule is configured to produce the signal in the presence of a triglyceride.

326. The system of claim 309, wherein the analyte comprises homocysteine, and wherein the receptor molecule is configured to produce the signal in the presence of a homocysteine.

25 327. The system of claim 309, wherein the analyte comprises an anticonvulsive drug, and wherein the receptor molecule is configured to produce the signal in the presence of an anticonvulsive drug.

328. The system of claim 309, wherein the analyte comprises an amphetamine, and wherein the receptor molecule is configured to produce the signal in the presence of an amphetamine.

329. The system of claim 309, wherein the analyte comprises a barbiturate, and wherein the

receptor molecule is configured to produce the signal in the presence of an barbiturate.

330. The system of claim 309, wherein the analyte comprises a benzodiazepine, and wherein the receptor molecule is configured to produce the signal in the presence of a benzodiazepine.

5

331. The system of claim 309, wherein the analyte comprises an opiate, and wherein the receptor molecule is configured to produce the signal in the presence of an opiate.

332. The system of claim 309, wherein the analyte comprises cocaine, and wherein the receptor molecule is configured to produce the signal in the presence of cocaine.

10

333. The system of claim 309, wherein the analyte comprises marijuana, and wherein the receptor molecule is configured to produce the signal in the presence of marijuana.

15

334. The system of claim 309, wherein the analyte comprises an electrolyte, and wherein the receptor molecule is configured to produce the signal in the presence of an electrolyte.

20

335. The system of claim 309, wherein the analyte comprises feline leukemia and wherein the receptor comprises feline leukemia antigen.

25

336. The system of claim 309, wherein the light source comprises a light emitting diode.

337. The system of claim 309, further comprising a fluid delivery system coupled to the supporting member.

25

338. The system of claim 309, wherein the detector comprises a charge-coupled device.

339. The system of claim 309, wherein the particle ranges from about 0.05 micron to about 500 microns.

340. The system of claim 309, wherein a volume of the particle changes when contacted with  
the fluid.

5 341. The system of claim 309, wherein the particle comprises a receptor molecule coupled to a  
polymeric resin.

10 342. The system of claim 309, wherein the particle comprises a receptor molecule coupled to a  
polymeric resin, and wherein the polymeric resin comprises polystyrene-polyethylene glycol-

divinyl benzene.

343. The system of claim 309, wherein the particle comprises a receptor molecule coupled to a  
polymeric resin, and wherein the particles further comprises a first indicator and a second  
indicator, the first and second indicators being coupled to the receptor, wherein the  
interaction of the receptor with the analyte causes the first and second indicators to interact  
such that the signal is produced.

20 344. The system of claim 309, wherein the particle comprises a receptor molecule coupled to a  
polymeric resin, and wherein the particles further comprises an indicator, wherein the  
indicator is associated with the receptor such that in the presence of the analyte the indicator

is displaced from the receptor to produce the signal.

345. The system of claim 309, wherein the supporting member comprises silicon.

25 346. The system of claim 309, wherein the system comprises a plurality of particles positioned  
within a plurality of cavities, and wherein the system is configured to substantially  
simultaneously detect a plurality of analytes in the fluid.

347. A method of sensing an analyte in a bodily fluid comprising:

5

passing the bodily fluid over a sensor array, the sensor array comprising at least one particle positioned within a cavity of a supporting member, wherein the particle is configured to produce a signal when the particle interacts with the analyte in the bodily fluid during use, and wherein the particle comprises a receptor molecule coupled to a polymeric resin; and

10

monitoring a spectroscopic change of the particle as the fluid is passed over the sensor array, wherein the spectroscopic change is caused by the interaction of the analyte with the particle.

15

348. The method of claim 347, wherein the analyte comprises bacteria, and wherein the receptor molecule comprises an antibody specific for the bacteria in the bodily fluid.
349. The method of claim 347, wherein the analyte comprises bacteria, and wherein the receptor molecule comprises an antigen specific for at least one type of antibody in the bodily fluid that is produced in response to the bacteria in the bodily fluid.
350. The method of claim 347, wherein the analyte comprises mastitis bacteria, and wherein the receptor molecule comprises an antibody specific for mastitis bacteria.
- 20  
25
351. The method of claim 347, wherein the bodily fluid comprises a plurality of bacteria, and wherein the sensor array includes a plurality of cavities with a plurality of particles, wherein each particle comprises a receptor configured to produce a signal in the presence of at least one of the bacteria present in the fluid sample.

352. The method of claim 347, wherein the analyte comprises mycobacterium tuberculosis, and wherein the receptor molecule comprises an antibody specific for mycobacterium tuberculosis.

353. The method of claim 347, wherein the analyte comprises a parasite, and wherein the receptor molecule comprises an antibody specific for the parasite in the bodily fluid.

5 354. The method of claim 347, wherein the analyte comprises a parasite, and wherein the receptor molecule comprises an antigen specific for at least one type of antibody in the bodily fluid that is produced in response to the parasite in the bodily fluid.

10 355. The method of claim 347, wherein the analyte comprises heartworm microfilaria, and wherein the receptor molecule comprises an antibody specific for heartworm microfilaria.

356. The method of claim 347, wherein the analyte comprises a virus, and wherein the receptor molecule comprises an antibody specific for the virus in the bodily fluid.

15 357. The method of claim 347, wherein the analyte comprises a virus, and wherein the receptor molecule comprises an antigen specific for at least one type of antibody in the bodily fluid that is produced in response to the virus in the bodily fluid.

20 358. The method of claim 347, wherein the analyte comprises feline leukemia virus, and wherein the receptor molecule comprises an antibody specific for feline leukemia virus.

359. The method of claim 347, wherein the analyte comprises HIV virus, and wherein the receptor molecule comprises an antibody specific for HIV virus.

25 360. The method of claim 347, wherein the analyte comprises hepatitis C virus, and wherein the receptor molecule comprises an antibody specific for hepatitis C virus.

361. The method of claim 347, wherein the analyte comprises a carbohydrate, and wherein the receptor molecule is configured to produce the signal in the presence of a carbohydrate.

362. The method of claim 347, wherein the analyte comprises a steroid, and wherein the receptor molecule is configured to produce the signal in the presence of a steroid.
- 5 363. The method of claim 347, wherein the analyte comprises a triglyceride, and wherein the receptor molecule is configured to produce the signal in the presence of a triglyceride.
364. The method of claim 347, wherein the analyte comprises homocysteine, and wherein the receptor molecule is configured to produce the signal in the presence of a homocysteine.
- 10
365. The method of claim 347, wherein the analyte comprises an anticonvulsive drug, and wherein the receptor molecule is configured to produce the signal in the presence of an anticonvulsive drug.
- 15
366. The method of claim 347, wherein the analyte comprises an amphetamine, and wherein the receptor molecule is configured to produce the signal in the presence of an amphetamine.
367. The method of claim 347, wherein the analyte comprises a barbiturate, and wherein the receptor molecule is configured to produce the signal in the presence of an barbiturate.
- 20
368. The method of claim 347, wherein the analyte comprises a benzodiazepine, and wherein the receptor molecule is configured to produce the signal in the presence of a benzodiazepine.
369. The method of claim 347, wherein the analyte comprises an opiate, and wherein the receptor molecule is configured to produce the signal in the presence of an opiate.
- 25
370. The method of claim 347, wherein the analyte comprises cocaine, and wherein the receptor molecule is configured to produce the signal in the presence of cocaine.

371. The method of claim 347, wherein the analyte comprises marijuana, and wherein the receptor molecule is configured to produce the signal in the presence of marijuana.

372. The method of claim 347, wherein the analyte comprises an electrolyte, and wherein the receptor molecule is configured to produce the signal in the presence of an electrolyte.  
5

373. The method of claim 347, wherein the analyte comprises feline leukemia and wherein the receptor comprises feline leukemia antigen.

10 374. The method of claim 347, wherein the spectroscopic change comprises a change in absorbance of the particle.

375. The method of claim 347, wherein the spectroscopic change comprises a change in fluorescence of the particle.

376. The method of claim 347, wherein the spectroscopic change comprises a change in phosphorescence of the particle.

377. The method of claim 347, wherein the particle comprises a receptor coupled to a polymeric resin, and further comprising exposing the particle to an indicator prior to passing the fluid over the sensor array.  
20

25 378. The method of claim 347, wherein the particle comprises a receptor coupled to a polymeric resin, and further comprising exposing the particle to an indicator prior to passing the fluid over the sensor array, and wherein a binding strength of the indicator to the receptor is less than a binding strength of the analyte to the receptor.

379. The method of claim 347, wherein the particle comprises a receptor coupled to a polymeric resin, and further comprising exposing the particle to an indicator prior to passing

the fluid over the sensor array, and wherein the indicator is a fluorescent indicator.

380. The method of claim 347, further comprising treating the fluid with an indicator prior to passing the fluid over the sensor array, wherein the indicator is configured to couple with the  
5 analyte.

381. The method of claim 347, wherein the analyte is bacteria and further comprising breaking down the bacteria prior to passing the fluid over the sensor array.

10 382. The method of claim 347, wherein monitoring the spectroscopic change is performed with a CCD device.

383. The method of claim 347, further comprising measuring the intensity of the spectroscopic change, and further comprising calculating the concentration of the analyte based on the intensity of the spectroscopic change.

384. The method of claim 347, wherein the supporting member comprises silicon.

385. The method of claim 347, wherein the spectroscopic change comprises a change in reflectance of the particle.  
20

386. The method of claim 347, wherein the cavity is configured such that the fluid entering the cavity passes through the supporting member.

25 387. The method of claim 347, wherein monitoring the spectroscopic change comprises:  
directing a red light source at the particle;  
  
detecting the absorbance of red light by the particle;

directing a green light source at the particle;  
detecting the absorbance of green light by the particle;  
5           directing a blue light source at the particle; and  
detecting the absorbance of blue light by the particle.

388. The method of claim 347, wherein the sensor array further comprises a vacuum chamber  
10       coupled to a conduit and the sensor array , and wherein the chamber is configured to provide  
a pulling force on the fluid in the sensor array.
389. The method of claim 347, wherein the fluid is blood.
390. The method of claim 347, further comprising passing the fluid through a filter prior to  
15       passing the fluid over the sensor array.
391. The method of claim 347, further comprising passing the fluid through a reagent reservoir  
prior to passing the fluid over the sensor array.  
20
392. The method of claim 347, wherein the particle comprises a polymeric resin, a biopolymer  
coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in  
the presence of the analyte to produce a signal.
- 25       393. The method of claim 347, wherein the particle comprises a polymeric resin, a biopolymer  
coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in  
the presence of the analyte to produce a signal, and wherein the signal comprises an  
absorbance of the particle.

394. The method of claim 347, wherein the particle comprises a polymeric resin, a biopolymer coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the signal comprises a fluorescence of the particle.

5

395. A system for detecting a nucleic acid analyte in a fluid comprising:

a light source;

10 a sensor array, the sensor array comprising a supporting member comprising at least one cavity formed within the supporting member;

15 a particle, the particle positioned within the cavity, wherein the particle is configured to produce a signal when the particle interacts with the nucleic acid analyte during use;

20 a detector, the detector being configured to detect the signal produced by the interaction of the nucleic acid analyte with the particle during use;

wherein the light source and detector are positioned such that light passes from the light source, to the particle, and onto the detector during use.

25 396. The system of claim 395, wherein the particle comprises a DNA oligomer and the nucleic acid analyte comprises DNA, and wherein the DNA oligomer has a sequence that is complementary to a DNA sequence of the nucleic acid analyte.

397. The system of claim 395, wherein the particle comprises an RNA oligomer and the nucleic acid analyte comprises DNA, and wherein the RNA oligomer has a sequence that is complementary to a DNA sequence of the nucleic acid analyte.

398. The system of claim 395, wherein the particle comprises a DNA oligomer and the nucleic acid analyte comprises RNA, and wherein the DNA oligomer has a sequence that is complementary to an RNA sequence of the nucleic acid analyte.

5 399. The system of claim 395, wherein the particle comprises a RNA oligomer and the nucleic acid analyte comprises RNA, and wherein the RNA oligomer has a sequence that is complementary to an RNA sequence of the nucleic acid analyte.

400. The system of claim 395, wherein the particle comprises a DNA-binding molecule.

10

401. The system of claim 395, wherein the particle comprises a protein.

402. The system of claim 395, wherein the particle comprises an enzyme.

15 403. The system of claim 395, wherein the particle has a sequence that is complementary to the sequence of the nucleic acid analyte, such that the particle and nucleic acid analyte form a matched or a mismatched duplex.

20 404. The system of claim 403, further comprising ribonuclease, wherein the ribonuclease is configured to dispose of the mismatched duplex.

405. The system of claim 404, wherein the ribonuclease is RNase A, RNase T1, or RNase T2.

25

406. The system of claim 403, further comprising nuclease, wherein the nuclease is configured to dispose of the mismatched duplex.

407. The system of claim 406, wherein the nuclease is S1 nuclease.

408. The system of claim 403, further comprising a Mispair Recognition Protein, wherein the

Mispair Recognition Protein is configured to bind the mismatched duplex.

409. The system of claim 408, wherein the Mispair Recognition Proteins is MutS or MutY in combination with thymine glycosylase.

5

410. The system of claim 403, further comprising a modified form of a mismatch recognition protein configured to cleave the mismatched duplex.

411. The system of claim 403, further comprising biotin and avidin, wherein the biotin is configured to bind to the mismatched duplex, and wherein the mismatched duplex bound to

10 biotin is removed by binding to avidin.

412. The system of claim 395, further comprising a recombinase protein, wherein the particle has a sequence that is complementary to the sequence of the nucleic acid analyte, and wherein the recombinase protein catalyzes the formation of a particle analyte duplex.

413. The system of claim 395, further comprising DNA ligase, wherein:

the analyte comprises an oligonucleotide;

20 the particle comprises an oligonucleotide; and

the DNA ligase is configured to ligate the analyte and the particle, wherein a single base pair mismatch at a junction of the analyte and particle will prevent ligation.

25

414. The system of claim 413, wherein a label is coupled to the analyte and to the particle.

415. The system of claim 395, wherein the particle comprises an intercalator and a polymeric bead.

416. The system of claim 415, wherein the intercalator is hydroxylamine, potassium permanganate, tetraethyl ammonium acetate, osmium tetroxide, ethidium bromide, POTO, or Texas Red.

5

417. The system of claim 415, further comprising a DNA piperidine, wherein the particle has a sequence that is complementary to the sequence of the nucleic acid analyte, such that the particle and nucleic acid analyte form a matched or a mismatched duplex and wherein the DNA piperidine is configured to cleave the mismatched duplex.

10

418. The system of claim 395, wherein the light source comprises a light emitting diode.

15  
20  
25

419. The system of claim 395, further comprising a fluid delivery system coupled to the supporting member.

420. The system of claim 395, wherein the detector comprises a charge-coupled device.

421. The system of claim 395, wherein the particle ranges from about 0.05 micron to about 500 microns.

20

422. The system of claim 395, wherein a volume of the particle changes when contacted with the fluid.

25

423. The system of claim 395, wherein the particle comprises a receptor molecule coupled to a polymeric resin.

424. The system of claim 423, wherein the polymeric resin comprises polystyrene-polyethylene glycol-divinyl benzene.

425. The system of claim 423, wherein the particles further comprises a first indicator and a second indicator, the first and second indicators being coupled to the receptor, wherein the interaction of the receptor with the analyte causes the first and second indicators to interact such that the signal is produced.

5

426. The system of claim 423, wherein the particles further comprises an indicator, wherein the indicator is associated with the receptor such that in the presence of the analyte the indicator is displaced from the receptor to produce the signal.

10 427. The system of claim 395, wherein the supporting member comprises silicon.

428. A sensor array for detecting a nucleic acid analyte in a fluid comprising:

a supporting member, wherein a plurality of cavities are formed within the supporting member;

a plurality of particles, at least one particle being positioned in each of the cavities, wherein the particles are configured to produce a signal when the particles interact with the analyte.

20 429. The system of claim 429, and wherein the system is configured to substantially simultaneously detect a plurality of analytes in the fluid.

25 430. The sensor array of claim 429, wherein the particles comprise a plurality of intercalculators.

431. The sensor array of claim 429, further comprising channels in the supporting member, wherein the channels are configured to allow the fluid to flow through the channels into and away from the cavity.

432. The sensor array of claim 429, further comprising a barrier layer positioned over the cavity, the barrier layer being configured to inhibit dislodgment of the particle during use.

5 433. The sensor array of claim 432, wherein the barrier layer comprises a substantially transparent cover plate positioned over the cavity, and wherein the cover plate is positioned a fixed distance over the cavity such that the fluid can enter the cavity.

10 434. The sensor array of claim 429, wherein the supporting member comprises a plastic material.

15 435. The sensor array of claim 429, wherein the supporting member comprises a dry film photoresist material.

436. The sensor array of claim 429, wherein the cavities are configured such that the fluid entering the cavities passes through the supporting member during use.

20 437. The sensor array of claim 436, further comprising a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavities.

438. The sensor array of claim 437, wherein a channel is formed in the supporting member, and wherein the channel couples the pump to the cavity such that the fluid flows through the channel to the cavity during use.

25 439. The sensor array of claim 437, further comprising a vacuum apparatus, wherein the vacuum apparatus is coupled to the cavity, and wherein the vacuum apparatus is configured to pull the fluid through the cavity during use.

440. A method of sensing a nucleic acid analyte in a fluid comprising:

passing a first fluid over a sensor array, the sensor array comprising at least one particle positioned within a cavity of a supporting member, the particle comprising a receptor coupled to a polymeric resin, wherein the receptor is configured to produce a signal when the receptor

5 interacts with the nucleic acid analyte during use; and

monitoring a signal produced by the particle as the fluid is passed over the sensor array, wherein the presence of the signal indicates the presence of the analyte.

10 441. The method of claim 440, wherein the signal comprises a change in the absorbance of the particle.

442. The method of claim 440, wherein the signal comprises a change in the fluorescence of the particle.

443. The method of claim 440, wherein the receptor comprises RNA, and wherein the analyte comprises DNA, and further comprising treating the particle with a ribonuclease after passing the fluid over the sensor array.

20 444. The method of claim 440, wherein the receptor comprises RNA, and wherein the analyte comprises RNA, and further comprising treating the particle with a ribonuclease after passing the fluid over the sensor array.

445. The method of claim 440, wherein the receptor comprises DNA, and wherein the analyte comprises DNA, and further comprising treating the particle with an S1 nuclease after passing the fluid over the sensor array.

446. The method of claim 440, wherein the receptor comprises RNA, and wherein the analyte comprises RNA, and further comprising treating the particle with an S1 nuclease after

passing the fluid over the sensor array.

447. The method of claim 440, wherein the receptor comprises DNA, and wherein the analyte comprises DNA, and further comprising treating the particle with an intercalator and piperidine after passing the fluid over the sensor array.

448. The method of claim 440, wherein the receptor comprises a protein, and wherein the analyte comprises DNA.

10 449. The method of claim 440, wherein the receptor comprises a protein, and wherein the analyte comprises RNA.

450. The method of claim 440, wherein the receptor comprises DNA, and wherein the analyte comprises DNA, and further comprising treating the particle with DNA ligase after passing the fluid over the sensor array.

451. The method of claim 440, further comprising amplifying the nucleic acid present in the fluid using a polymerase chain reaction prior to passing the fluid over the sensor array.

120 452. The method of claim 440, further comprising amplifying the nucleic acid present in the fluid using a ligase chain reaction prior to passing the fluid over the sensor array.

453. The method of claim 440, wherein the analyte comprises DNA, and further comprising forming an RNA copy of the analyte prior to passing the fluid over the sensor array.

25 454. The method of claim 440, wherein the receptor further comprises an indicator.

455. The method of claim 440, further comprising passing a second fluid over the sensor array, the second fluid comprising an intercalator.

456. The method of claim 455, wherein the intercalator is hydroxylamine, potassium permanganate, tetraethyl ammonium acetate, osmium tetroxide, ethidium bromide, POTO, or Texas Red.

5

457. The method of claim 455, further comprising passing DNA piperidine over the sensor array.

458. The method of claim 440, wherein further comprising passing a second fluid over the  
10 sensor array, the second fluid comprising Mispair Recognition Proteins.

10

459. The method of claim 440, wherein the receptor comprises an oligonucleotide and wherein  
the analyte comprises an oligonucleotide, and further comprising passing DNA ligase over  
the sensor array and scoring ligation by assaying for labels on the oligonucleotides becoming  
present in a single molecule.